PATENT
Attorney Docket No. AI 431NP

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Kouji Kitahata et al.	Confirmation No. 4741
Serial No.: 10/593,820	Group Art Unit: 1797
Filed: September 22, 2006	Examiner: Taiwo Oladapo
For: LUBRICANT COMPOSITION, SPEED REDUCTION GEAR USING THE LUBRICANT COMPOSITION, AND ELECTRIC POWER STEERING APPARATUS USING THE SPEED REDUCTION GEAR	

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

RULE 132 DECLARATION

I, Kouji Kitahata do hereby declare the followings:

I am a citizen of Japan, residing at 3-13-11, Sakurazaka, Kanan-cho, Minamikawachi-gun, Osaka 585-0025, Japan;

I graduated from the Department of Applied Chemistry, the college of Science & Engineering at Ritsumeikan University in 1984;

I was accepted for employment by Koyo Seiko Co., Ltd., presently JTEKT Corporation, in 1992 and was engaged in research on grease in Material Research & Development Dept. at the time of application of the subject patent application.

I am a co-inventor of the invention disclosed and claimed in the subject patent application and I know that an Office Action dated September 1, 2010 has been issued

which states that the invention described in the claims of the subject patent application are unpatentable by Nakatani et al. in view of Aoki et al.

Thus, in order to prove that the solid lubricant with an average particle diameter less than 100 μm, described in Aoki et al., cannot function as the buffer particles in the present invention, the following test was conducted by myself or under my supervision.

<<Tests>>

<Resin Particles>

Eight types of resin particles made of thermosetting urethane resin and having the average particle diameters shown in Table 1 below were prepared.

<Preparation of lubricant compositions>

Each lubricant composition was prepared by using a three-roll mill to mix grease, containing a synthetic hydrocarbon oil [PAO8 Grade, kinematic viscosity: 48 mm^2/s (40°C)] as a lubricating base oil and a calcium sulfonate-based thickener, while adding and mixing in the same lubricating base oil and one type of resin particles among the eight types mentioned above. The amount of the additional lubricant base oil was adjusted so that a mixing consistency (25°C) of the lubricant composition was approximately 400.

As the calcium sulfonate-based thickener, a complex of petroleum sulfonic acid calcium sulfonate and the four kinds of calcium salts of calcium carbonate, calcium dihydroxystearate, calcium acetate, and calcium borate was used.

The amount of resin particles was adjusted to 25 parts by mass with respect to a total amount of 100 parts by mass of the lubricant base oil and the calcium sulfonate-

based thickener, and the proportion of the resin particles in the total amount of the lubricant composition was thus adjusted to 20% by mass.

<Measurements of tooth striking sound and steering torque>

An actual speed reduction gear of an electric power steering apparatus shown in Figs. 1 and 2 of the present specification was filled with each of the lubricant compositions produced in the above preparation and a tooth striking sound (dB(A)) and a steering torque generated when an actual steering operation was performed were measured. In a worm gear mechanism, a worm made of an iron-based metal was combined with a worm wheel made of a polyamide-based resin. Backlash was set to 2'.

The results are shown together with results for a case where resin particles were not added in Table 1, Fig. 1, and Fig. 2. Fig. 1 shows a relationship of the average particle diameter (μm) of the resin particles and the tooth striking sound, and Fig. 2 shows a relationship of the average particle diameter (μm) and the steering torque.

Table 1

Average particle diameter (μm)	Tooth striking sound [db(A)]	Steering torque [N·m]
-	64	0.3
50	62	0.4
100	55	0.6
150	51	0.8
200	49	1
250	48.5	1.2
300	48	1.5
350	47.5	1.8
400	47	2

Fig. 1

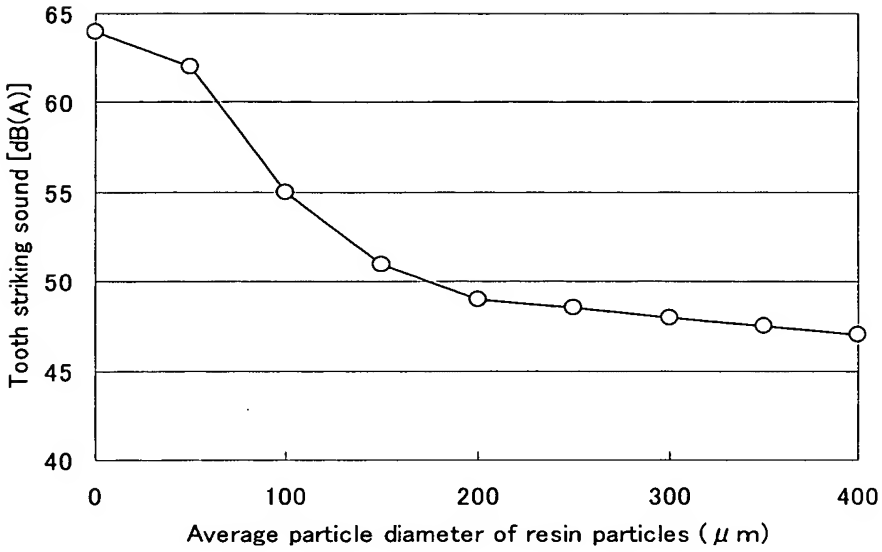
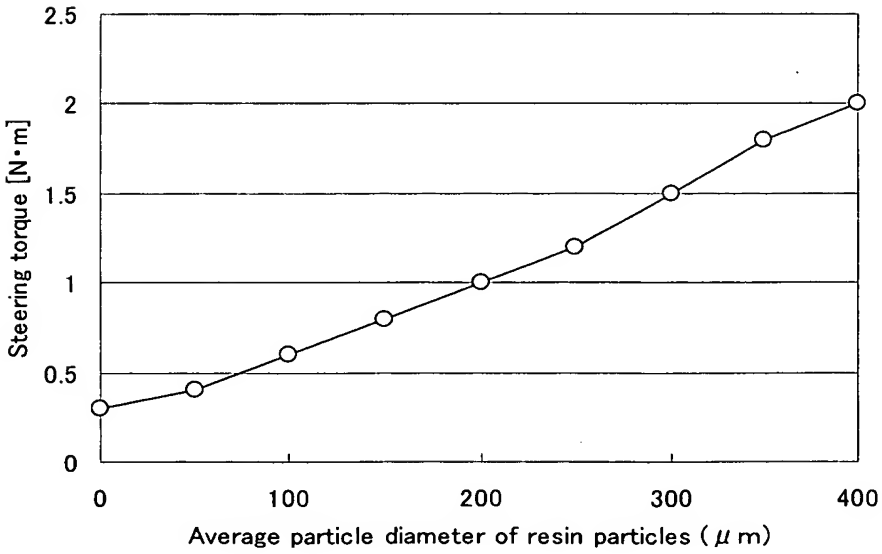


Fig. 2



As is apparent from the results of Table 1 and Fig. 1, with the lubricant compositions in which resin particles with an average particle diameter of less than 100

μm are blended, the tooth striking sound was significantly louder in comparison to the lubricant compositions in which resin particles with an average particle diameter of no less than 100 μm are blended. From these results, it was confirmed that resin particles with an average particle diameter of less than 100 μm cannot function as buffer particles.

It is also apparent from the results of Table 1 and Fig. 2 that with the lubricant compositions in which resin particles with an average particle diameter exceeding 200 μm are blended, the steering torque was significantly high in comparison to the lubricant compositions in which resin particles with an average particle diameter of no more than 200 μm are blended.

<<Conclusion>>

The test results confirm that the solid lubricant with an average particle diameter less than 100 μm, described in Aoki et al., cannot function as the buffer particles in the present invention.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 10th of December, 2010 By: Kouji Kitahata

Kouji KITAHATA